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Attachment No. 2

INITIAL STATEMENT OF REASONS**CALIFORNIA CODE OF REGULATIONS**

**TITLE 8: Chapter 4, Subchapter 7, Article 107, Section 5154.1
of the General Industry Safety Orders**

Ventilation Requirements for Laboratory-Type Hood Operations**SUMMARY**

Existing Section 5154.1, Ventilation Requirements for Laboratory-Type Hood Operations, provides minimum requirements for the protection of employees when laboratory-type hoods are used to prevent harmful exposure to toxic material. Section 5154.1 specifies minimum ventilation and performance requirements, limitations on the use of laboratory type hoods, and several specific requirements related to the design and use of laboratory-type hoods. The specific requirements relate to concentrations of flammable materials in the hood and duct, hazards associated with the exhaust stack, blowers, biological contaminants, use with perchloric acid, placarding of deficient hoods, devices used to indicate airflow, and a requirement that the inward flow into the hood be demonstrated.

The objectives of proposed revisions to Section 5154.1 are to improve the performance of laboratory-type fume hoods when they are used to control harmful exposure to toxic materials or reduce the potential risk of fire and explosion. Labor Code Section 144.6 requires the Occupational Safety and Health Standards Board (Board) to adopt standards for toxic materials that assure that no employee suffers material impairment or loss of functional capacity from exposure to such materials. Laboratory-type hoods are used to control the extent to which employees are exposed to toxic materials and the risk of fire and explosion. Section 5154.1 is intended to place requirements on the use and performance of laboratory-type hoods that make the hoods effective as devices to control these hazards. Other changes are proposed that will clarify existing requirements, but not substantively change them.

The proposed changes were developed by the Division of Occupational Safety and Health (Division). The changes are based on an earlier proposal that was developed with the assistance of an advisory committee that met six times between May 2, 2000, and August 8, 2001. There was also an additional advisory meeting held September 17, 2003, to discuss issues raised at a May 22, 2003, public hearing on the earlier proposal. The changes described below are based on recommendations from all the above sources.

Changes are proposed to the current definitions of the terms “hazardous substance” and “laboratory-type hood” in subsection (b). The change to the term “hazardous substance” is intended to clarify that hazardous substances are those likely to cause injury or illness if not used with effective control methods, and not substantively alter the meaning of the term. The term “laboratory-type hood” is changed to indicate that laboratory-type hoods are used to control exposures to hazardous substances as compared with the current description as a device in which they are used. This change is intended to make the definition of laboratory-type hood consistent with the change to the term “hazardous substance.”

Subsection (c), Ventilation Rates, is changed by adding an option to operate the laboratory-type hood at a reduced average face velocity of 60 feet per minute (fpm) if the hood is not being accessed by an operator and other specified conditions are met. The effect of this change will be to provide a reduced ventilation rate while not compromising the ability of the laboratory-type hood to contain the hazardous substances in the hood. A non-substantive change is also proposed to change the current velocity units from “linear feet per minute” to “feet per minute.” This change is necessary to make the velocity unit consistent with the units used in other ventilation standards.

The requirement in subsection (e)(2) to install sash closure restrictions is changed to permit hoods to operate without a permanent sash stop, provided other openings into the hood such as the space under an airfoil are sufficient to ventilate the hood for explosion control. The change is necessary to eliminate the need for installing unnecessary sash stops in these cases.

The requirements in subsection (e)(3) are changed by replacing the current requirement for a continuous qualitative airflow indicator to a requirement for a continuous quantitative monitor. The requirement for a periodic inward airflow demonstration is also changed to require that it be conducted on an annual basis, as well as at installation, repairs or renovation, and the addition of large equipment into the hood. The change includes an exception permitting biannual airflow demonstration and velocity measurement if a calibration and maintenance program is in place for the quantitative airflow monitor or alarm system. The effect of this change will be to provide the hood user with a means of detecting changes in the airflow into the hood which cannot be detected with qualitative indicators and can cause significant reduction in the ability of the hood to control harmful exposure. The requirement for a specific procedure to demonstrate inward airflow on an annual basis is necessary to improve the reliability of the airflow demonstration to detect hoods with inadequate capture and containment characteristics initially and over time.

The requirement in subsection (e)(7) specifying construction materials is changed to include references to more recent polymer materials which are suitable for construction of laboratory-hoods that are used in perchloric acid evaporation processes. This change is not intended to substantively alter the current requirement. The change is necessary to reduce uncertainty when these more recent materials are used.

The proposal adds a new subsection regarding hood operator qualifications. The subsection requires that employers take steps to ensure that employees understand the functional characteristics of the hood and are able to use the hood safely. The subsection requires that the

employees be familiar with the performance testing requirements for the hood and can determine when the hood was last tested. This change is necessary to reduce the risk that (1) employees use laboratory-type hoods in an unsafe manner, (2) the employee is unaware that required performance tests have not been performed, and (3) the hood is currently operating in an unsafe manner.

SPECIFIC PURPOSE AND FACTUAL BASIS OF PROPOSED ACTION

The purpose of changes to the definitions for hazardous substance and laboratory-type hood in subsection (b) is to: (1) clarify that hazardous substances are those likely to cause injury or illness if not used with effective control methods, and (2) to make the definition of laboratory-type hood consistent with the change to the term "hazardous substance." The advisory committee cited the example of a fine lead powder possibly needing a laboratory hood, whereas a large solid piece of lead would likely not. The proposed changes are intended to clarify the meaning of these two terms while not substantively changing them.

The purpose of the change to subsection (c) that allows the face velocity of an unoccupied laboratory-type hood to be reduced to 60 fpm is to permit hoods meeting the stated conditions to operate at lower flow rates while providing protection equivalent or superior to that provided by a face velocity of 100 fpm with an operator present. In 1999, a paper was published in the ASHRAE Transactions, which examined the containment characteristics of three hoods with different designs using tracer gas tests specified in ANSI/ASHRAE 110-1995 (ref.1, Greenley). This experiment measured tracer gas leakage with a mannequin to simulate an operator at 100 fpm, and tracer gas leakage without a mannequin as an unoccupied hood at 60 fpm. The paper indicates that containment is as good or better at an unoccupied hood at 60 fpm than it is at an occupied hood (with a mannequin) at 100 fpm. As a prerequisite for operation at reduced velocity, one of the conditions requires the hood be tested at the reduced flow according to the ANSI/ASHRAE 110-1995 tracer gas test procedure and achieve a hood rating of 4 AU 0.1 or less. The advisory committee recommended that this test be performed to assure that the hood containment at reduced velocity is adequate to protect nearby workers. A laboratory-type hood that operates at reduced face velocities is more susceptible to room air currents than when it is operating at a higher face velocity with equivalent room air currents. These room air currents can be present with or without an operator and can contribute to contaminant escape from the hood. A paper was published in ASHRAE Transactions in 1977 (ref. 2, Caplan) that demonstrates the effect of room air currents with and without an operator (as simulated by a mannequin). Figure 4 of this paper, "Effect of room air challenge without dummy," demonstrates that the adverse effect of room air challenges on containment at low face velocity is much greater than equivalent room air challenges at higher hood face velocities. A hood with a given level of room air challenge and satisfactory performance at 100 fpm can deteriorate and allow contaminant escape when the flow is reduced to a 60 fpm level and when the room air challenge remains the same. The requirement that records of the most recent tracer gas test result and the "as used" test configuration be maintained for the duration of use at reduced flow and thereafter for five years is included to permit verification that the required tests have been performed.

Subsection (e)(2) is changed to eliminate the need for permanent sash stops when other features of the hood can provide sufficient ventilation for explosion control. The purpose of this change is to provide the employer an alternative to the installation of permanent sash stops when these stops are not necessary and the design of the hood provides the necessary minimum ventilation.

The requirements in subsection (e)(3) are changed by replacing the current requirement for a qualitative airflow indicator to a requirement for a quantitative monitor. The purpose of this change is to provide warning to the hood's operator that the airflow has changed, and may be reduced to a level insufficient to contain and capture air contaminants and prevent harmful exposure. Members of the advisory committee indicated that the current requirement for a means to continuously indicate that air is flowing into the exhaust system does not cover one of the most frequent safety problems found during routine hood surveys. The problem cited is a reduced flow without a total lack of flow. Belt slippage between the motor and blower was described as a common cause of this reduction. Duct blockage from cleaning wipes being sucked into the system was also mentioned as a cause. Members of the committee noted that in the absence of a flow gauge the unsafe condition could continue for up to one year before it was discovered in an annual survey. An alternative to the requirement for the quantitative flow monitor is also added that will allow an audible or visual alarm that is triggered at 80% of the flow required by subsection (c). This will allow hoods that currently have alarms that detect reduced flow to operate without the airflow monitor.

The requirement for inward airflow demonstration in subsection (e)(3) is also changed to be conducted on an annual basis, as well as at installation, repairs or renovation, and the addition of large equipment into the hood. The change includes an exception permitting biannual airflow demonstration and airflow measurement if a calibration and maintenance program is in place for the quantitative indicator. This change was recommended by the advisory committee as a more definite method to demonstrate the capture and containment characteristics of the hood.

The requirement at subsection (e)(7) specifying construction materials is changed to include references to more recent polymer materials which are suitable for construction of laboratory-hoods that are used in perchloric acid evaporation processes. This change was recommended by the advisory committee and is not intended to substantively alter the current requirement. This change is intended to reduce uncertainty when these more recent materials are used.

The advisory committee recommended adding a new subsection (f) regarding hood operator qualifications. The subsection is necessary to require that employers take steps to insure that employees understand the functional characteristics of the hood and are trained to use the hood safely. The subsection is also necessary to require that the employees be familiar with the performance testing requirements for the hood and can determine when the hood was last tested.

DOCUMENTS RELIED UPON

1. Containment Testing for Occupied and Unoccupied Laboratory Chemical Hoods, Pamela L. Greenley, Louis J. DiBerardinis, Fredrick A. Lorch, P.E., ASHRAE Transactions: Symposia; CH-99-9-1, pages 733 to 737.

2. The Effect of Room Air Challenge on the Efficiency of Laboratory Fume Hoods (RP-70), Knowlton J. Caplan, P.E., Gerhard W. Knutson, Ph.D., ASHRAE Transactions 1977, Volume 83, Part 1, pages 11 to 22.
3. Petition to the Occupational Safety and Health Standards Board by Mr. Richard Yardley of George Yardley Company, dated May 27, 1997; Petition File No. 377.
4. The Occupational Safety and Health Standards Board's Petition Decision for Petition File No. 377 dated September 25, 1997.
5. Petition to the Occupational Safety and Health Standards Board by Mr. George A. Orff of DMG Corporation, dated January 14, 1999; Petition File No. 395.
6. The Occupational Safety and Health Standards Board's Petition Decision for Petition File No. 395 dated May 20, 1999.

These documents are available for review Monday through Friday from 8:00 a.m. to 4:30 p.m. at the Standards Board Office located at 2520 Venture Oaks Way, Suite 350, Sacramento, California.

DOCUMENTS INCORPORATED BY REFERENCE

- Section 7, Tracer Gas Test Procedure, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., ANSI/ASHRAE 110-1995, Method of Testing Performance of Laboratory Fume Hoods.

This document is too cumbersome or impractical to publish in Title 8. Therefore, it is proposed to incorporate this document by reference. A copy of this document is available for review Monday through Friday from 8:00 a.m. to 4:30 p.m. at the Standards Board Office located at 2520 Venture Oaks Way, Suite 350, Sacramento, California.

REASONABLE ALTERNATIVES THAT WOULD LESSEN ADVERSE ECONOMIC IMPACT ON SMALL BUSINESSES

No reasonable alternatives were identified by the Board and no reasonable alternatives identified by the Board or otherwise brought to its attention would lessen the impact on small businesses.

SPECIFIC TECHNOLOGY OR EQUIPMENT

This proposal will not mandate the use of specific technologies or equipment.

COST ESTIMATES OF PROPOSED ACTION

Costs or Savings to State Agencies

Overall it is anticipated that the proposal would have no net costs and would allow state agencies and employers that use lab hoods to incur a significant savings. The proposal would require insignificant to no costs to be incurred for existing lab hoods. These costs would be more than offset by the significant energy savings that some agencies and employers may voluntarily take advantage of when under the proposal their lab hoods could be fitted with an automatic airflow control system that would reduce the airflow when the hood is unoccupied.

Based on information provided by the petitioner, it is estimated that roughly 85,000 hoods are in operation in California. Approximately 35% of these hoods are in state facilities, most of which are UC/CSU campuses. Another 35% of these hoods are located at community colleges, water quality laboratories, and high schools. The remaining 30% are located in the private sector, namely schools and biotech, chemical, or pharmaceutical companies.

Regarding the voluntary or permissive requirements of reducing the airflow into the lab hood as proposed in subsection (e)(2), significant cost savings can be realized if laboratory hoods are fitted with automatic airflow control systems as allowed by the proposed amendments. Assuming each lab hood consumes an average of 1,000 CFM and each CFM of single-pass air costs up to \$5 per year, each lab hood has an annual energy cost of \$5,000. It is estimated by the petitioner that lab hoods operated under this proposal could reduce energy airflow by 30-40% realizing an annual savings up to \$2,000. During the first year, this savings is likely to offset or exceed the initial installation, testing and recordkeeping expenses associated with the proposal since the petitioner knows of at least 2,000 lab hoods that are currently equipped with the technology and would take advantage of these energy savings once the standard becomes effective resulting in a minimum \$4 million savings in the first year. Thereafter, energy cost savings will continue up to \$2,000 per year for the thousands of hoods expected to take advantage of these significant energy savings. Based on these estimates, California public and private sector workplaces that utilize these setback type lab hoods would have an overall savings in the millions of dollars per year in energy costs.

The petitioner states that nearly all hoods installed within the past 10 to 15 years have quantitative airflow monitors or alarm systems that meet the proposed requirement in subsection (e)(3). The petitioner did a phone survey of state lab facilities and estimates that greater than 85% of those facilities already have monitors installed. Projecting that estimate to all hoods, less than 13,000 hoods would be affected by the requirement to install a quantitative monitor. Given that the average hood has an estimated lifespan of about 20 years, it is believed that this small percentage of older hoods would even be smaller when the proposal eventually phases into effect. Based on data provided by advisory committee members, it is estimated that the average one-time cost is approximately \$221 for the monitor or alarm system, including installation. Using the 13,000 older hood estimate, the total statewide estimated cost would be less than \$3 million. This cost is insignificant relative to the overall cost of hoods, along with operation and maintenance costs. A basic hood costs around \$5,000, and energy costs used to run the hood are approximately \$5,000 a year. Additionally, there are labor and administrative costs associated with operating and

maintaining the hood. Thus the cost of a quantitative airflow monitor or alarm system are insignificant in comparison and would be offset should employers take advantage of the automatic airflow control system, permitted in the proposal, which would reduce the amount of airflow into the hood when the hood is unoccupied.

Most employers are already complying with the proposed amendments to subsection (e)(3) that would require qualitative airflow measurements be performed annually. This measurement/test is already required upon installation, after repairs/renovations, or the addition of large equipment into the hood. An exception to this annual measurement/test is included, reducing the frequency to every two years if a calibration and maintenance program is in place for the quantitative airflow monitor or alarm system. If there are employers who are not already conducting such tests, the extra cost associated with this additional testing requirement averages approximately \$82, including equipment and labor. It should be noted that annual testing of a hood's ventilation rate is already required under Section 5143(a)(5). The requirement to measure the hoods ability to maintain an inward airflow at all openings of the hood on an annual basis in Section 5154.1(e)(3) could easily, and cost effectively, be incorporated into the already required annual test of ventilation rates. Therefore, it is estimated that this \$82 annual cost is already being performed to comply with existing Title 8 requirements, manufacturer recommendations and national consensus standards

The added training requirements prescribed in new subsection (f) of the proposal are not anticipated to add any additional costs to employers, as similar or closely related training would already be required under the employer's Injury Illness and Prevention Program specified in Section 3203 of the General Industry Safety Orders.

Impact on Housing Costs

The Board has made an initial determination that this proposal will not significantly affect housing costs.

Impact on Businesses

The Board has made an initial determination that this proposal will not result in a significant, statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states.

Cost Impact on Private Persons or Businesses

See "Costs or Savings to State Agencies."

Costs or Savings in Federal Funding to the State

The proposal will not result in costs or savings in federal funding to the state.

Costs or Savings to Local Agencies or School Districts Required to be Reimbursed

No costs to local agencies or school districts are required to be reimbursed. See explanation under “Determination of Mandate.”

Other Nondiscretionary Costs or Savings Imposed on Local Agencies

See “Costs or Savings to State Agencies.”

DETERMINATION OF MANDATE

The Occupational Safety and Health Standards Board has determined that the proposed standard does not impose a mandate requiring reimbursement by the state pursuant to Part 7 (commencing with Section 17500) of Division 4 of the Government Code because the proposed amendment will not require local agencies or school district to incur additional costs in complying with the proposal. Furthermore, this regulation does not constitute a “new program or higher level of service of an existing program with the meaning of Section 6 of Article XIII B of the California Constitution.”

The California Supreme Court has established that a “program” within the meaning of Section 6 of Article XIII B of the California Constitution is one which carries out the governmental function of providing services to the public, or which, to implement a state policy, imposes unique requirements on local governments and does not apply generally to all residents and entities in the state. (County of Los Angeles v. State of California (1987) 43 Cal.3d 46.)

The proposed standard does not require local agencies to carry out the governmental function of providing services to the public. Rather, the standard requires local agencies to take certain steps to ensure the safety and health of their own employees only. Moreover, the proposed standard does not in any way require local agencies to administer the California Occupational Safety and Health program. (See City of Anaheim v. State of California (1987) 189Cal.App.3d 1478.)

The proposed standard does not impose unique requirements on local government. All employers-state, local and private-will be required to comply with the prescribed standards.

EFFECT ON SMALL BUSINESSES

The Board has determined that the proposed amendments may affect small businesses. However, no economic impact is anticipated. See “Costs or Savings to State Agencies.”

ASSESSMENT

The adoption of the proposed amendments to this standard will neither create nor eliminate jobs in the State of California nor result in the elimination of existing businesses or create or expand businesses in the State of California.

ALTERNATIVES THAT WOULD AFFECT PRIVATE PERSONS

No reasonable alternatives have been identified by the Board or have otherwise been identified and brought to its attention that would be more effective in carrying out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.